hydrochemical surveys of springs and streamwaters. *Journal of Hydrology* 33, 199 – 213.

Stream Bryophyte Group (1999). Roles of bryophytes in stream ecosystems. *Journal of the North American Benthological Society* 18, 151 – 184.

Tetzlaff, D., Soulsby, C., Waldron, S., Malcolm, I.A., Bacon, P.J., Dunn, S.M., Lilly, A. & Youngson, A.F. (2007). Conceptualization of runoff processes using a geographical information system and tracers in a nested mesoscale catchment. *Hydrological Processes* 21, 1289 – 1307.

Vieira, C., Séneca, A., Sérgio, C. & Ferreira, M.T. (2012). Bryophyte taxonomic and functional groups as indicators of fine scale ecological gradients in mountain streams. *Ecological Indicators* 18, 98 – 107.

Virtanen, R., Muotka, T. & Saksa, M. (2001). Species richness standing crop relationship in stream bryophyte communities: patterns across multiple scales. *Journal of Ecology* 89, 14 – 20.

ELECTRONIC RESOURCES

http://www.bbsfieldguide.org.uk/sites/default/files/pdfs/mosses/Schistidium_agassizii.pdf

http://www.scotland.gov.uk/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL

https://data.nbn.org.uk/Taxa/NHMSYS0000310590

https://data.nbn.org.uk/Taxa/NHMSYS0000310590/Grid Map

http://www.sepa.org.uk/water/water_regulation/advertised_applications/idoc.ashx?docid=51ea134b-77c7-4b14-8e16-432c997a4e53&version=-1

Some uncommon desmids (Chlorophyta, Zygnemophyceae) encountered in the phytoplankton of Scottish lochs

Pauline Lang[1], Jan Krokowski[1] & Emma Goodyer[2]

[1]Ecology Assessment Unit, Scottish Environment Protection Agency, Angus Smith Building, 6 Parklands Avenue, Eurocentral, Holytown, North Lanarkshire, ML1 4WQ, Scotland, U.K.; [2]Ecology Partnership Development Unit, Scottish Environment Protection Agency, Bremner House, Castle Business Park, Stirling, FK9 4TF, Scotland, U.K.;

E-mail: pauline.lang@sepa.org.uk

Desmids are an idiosyncratic group of green algae (Chlorophyta, Zygnemophyceae) comprising two highly symmetrical halves or 'semi-cells', leading either a solitary or colonial existence (Coesel & Krienitz, 2008). They are usually found dwelling amongst the algal communities of standing freshwater habitats, widely ranging from upland bogs to lowland lakes (John & Williamson, 2009). Although some genera are often perceived as taxonomically 'easier' (e.g., *Micrasterias*) because they are intrinsically better defined than others (e.g., *Staurastrum*), the intricate semi-cell architecture and morphological continua displayed by desmids can make accurate species-level identification notoriously challenging (Brook & Williamson, 2010). For this reason, and coinciding with the limited accounts in at-hand published floras (themselves based on reliable records), there may be an inclination towards subjectively lumping desmid specimens under the appropriate genera or species of similar appearance. However, adopting this 'broad brush' approach is likely to have implications for establishing precise estimates of algal biodiversity and also, up to a point, water quality assessments, potentially masking the vulnerability of freshwater ecosystems to environmental threats such as eutrophication and climate change at the microscale.

In the course of analysing phytoplankton samples collected as part of the Scottish Environment Protection Agency's ongoing assessment of the ecological status of freshwater lochs in Scotland (see Lang *et al.*, 2013), a number of relatively uncommon desmids were discovered during the 2009 to 2010 monitoring period. In particular, six species (Table 1; Fig. 1*a* - *f*) did not match any desmids described by Brook (2002) for the British Isles. These did, however, more closely resemble taxa recorded from western Ireland as illustrated by John & Williamson (2009), suggesting an eco-geographical overlap of desmid assemblages between this region and north-west Scotland (from where most of the uncommon desmids presented here were derived). Three of the six species have since been included in the second edition of *The Freshwater Algal Flora of the British Isles* (Brook *et al.*, 2011), whilst the other desmids remain to be fully depicted (Table 1).

It seems that some of the less common desmids, defined by Brook *et al.* (2011) as those typically observed on fewer than five sampling occasions, may have been overlooked. Why? Firstly, it is a painstaking task documenting all of the *c.* 800 desmid species currently known to occur in Britain and Ireland, though this apparently overwhelming feat has been accomplished elsewhere (e.g., Brook & Williamson, 2010; John *et al.*, 2011). Nevertheless, a published flora is not necessarily a definitive list. Extensive surveillance monitoring, akin to that of

SEPA's sampling framework, can be crucial in uncovering specimens new to a locality (e.g., Lang *et al.*, 2013), or even to science, thereby adding records to the catalogue through time. For the most part, however, this work is conducted from the perspective of meeting legislative requirements (e.g., EU Water Framework Directive: European Commission, 2000), and though widespread across Scotland, does not entail an exhaustive sampling programme. Neither is its primary aim to capture desmid diversity.

Table 1. Floristic list of some uncommon desmids, their distribution and abundance in Scottish lochs monitored by SEPA during 2009 and 2010. Abbreviations: LA = low alkalinity; MA = moderate alkalinity; HA = high alkalinity; VS = very shallow; S = shallow; D = deep. Initials 'DW' denote desmids recorded by David Williamson.

Desmid species	Sample location (NGR)	Lake typology	Annual mean pH (2009–2010)	Annual mean Total Phosphorus concentration(µg L^{-1}) (2009–2010)	Desmid abundance	Included in Brook *et al.* (2011)?	Highlighted in Brodie *et al.* (2007)?
Cosmarium dybowskii **Gutwinski 1896 (Fig. 1*a*)**	**Loch Ussie (NH 50448 57194)**	**MA; VS**	**7.53**	**16.76**	**Infrequent**	**Yes**	**Yes, Endangered – rare and habitat endangered (category 2) 1 record by DW**
	Loch Veyatie (NC 20154 12305)	**HA; S**	**7.54**	**8.71**	**Infrequent**		
Staurastrum cornutum **W. Archer 1881 (Fig. 1*b*)**	**Loch Naver (NC 61807 36706)**	**LA; S**	**6.46**	**5.11**	**Infrequent**	**Yes**	**No**
Staurastrum grande **Bulnheim 1861 (Fig. 1*c*)**	**Loch Stack (NC 27710 43163)**	**LA; S**	**6.69**	**6.83**	**Infrequent**	**Yes**	**No**
Staurastrum kouwetsii **Coesel 1996 (Fig. 1*d*)**	**Loch Langavat (NG 04687 89217)**	**LA; S**	**6.31**	**15.33**	**Infrequent**	**No**	**Yes, Endangered – rare and habitat endangered (category 2) 4 records by DW**
Staurastrum laeve **Ralfs 1848 (Fig. 1*e*)**	**Loch Frisa (NM 51080 47026)**	**MA; D**	**7.14**	**7.96**	**Common**	**No**	**Yes, Endangered – rare and habitat endangered (category 2) 2 records by DW**
Staurastrum tohopekaligense **Wolle 1885 (Fig. 1*f*)**	**Loch Shin (NC 56682 07336)**	**LA; D**	**6.21**	**8.96**	**Infrequent**	**No**	**Yes, Endangered – rare and habitat endangered (category 2) 2 records by DW**

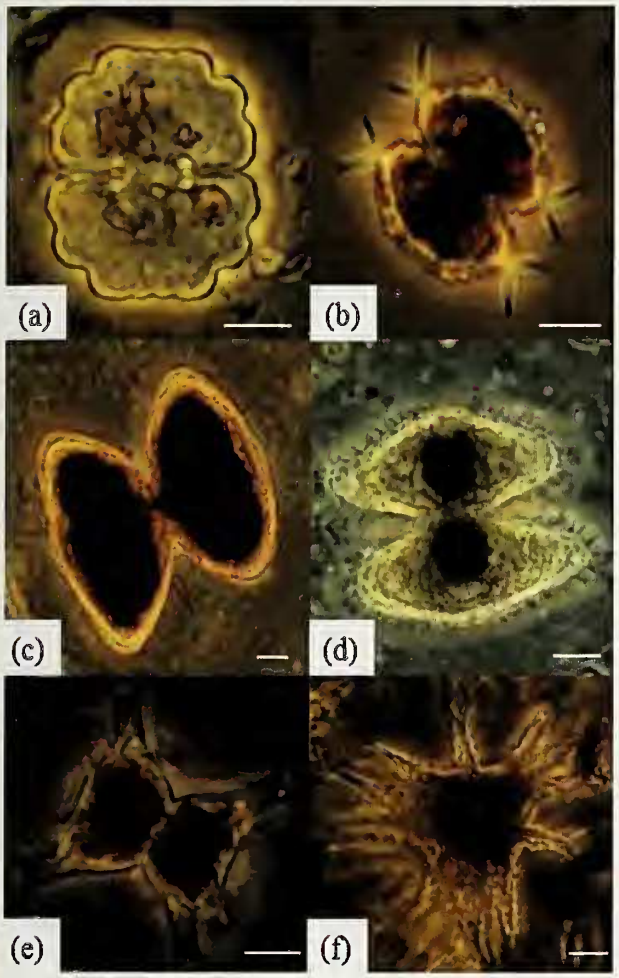

Fig. 1. Photo-micrographs of (*a*) *Cosmarium dybowskii*; (*b*) *Staurastrum cornutum*; (*c*) *Staurastrum grande*; (*d*) *Staurastrum kouwetsii*; (*e*) *Staurastrum laeve*; (*f*) *Staurastrum tohopekaligense* preserved in Lugol's iodine. Scalebar = 10 µm.

When we happen to observe these green wonders of symmetry, mostly in phytoplankton samples collected from oligotrophic to slightly mesotrophic water bodies, an occasional species crops up as a 'chance plankter' (Brook et *al.*, 2011). Adopting an approach that focuses on collecting desmid material from lake shorelines (e.g., squeezing marginal vegetation) would probably reveal more about this particular group of algae than open-water phytoplankton sampling alone. Similarly, blanket mires can be excellent places for spotting desmids, their communities in such habitats often being incredibly species rich (Goodyer, 2013). Secondly, several of the desmid species mentioned here are considered endangered (Brodie *et al.*, 2007; Table 1).

Hence, careful taxonomy is needed to recognise such rare species and documenting their occurrence could help to protect threatened desmid habitats in the future. Lastly, an important point is that the situation is by no means limited to desmids. Algal taxonomy is becoming increasingly renowned as a dying trade (Brodie *et al.*, 2008). Apart from a handful of us deemed expertly proficient U.K.-wide, there are too few actively hunting for the 'green stuff', even though exciting new finds are waiting to be discovered (e.g., Goodyer, 2013; Lang *et al.*, 2013). This illustrates SEPA's lead role in algae-based assessments of water quality in Scotland, which also generates fundamental knowledge concerning the biodiversity and ecological distribution of algae from the local to national level.

We felt it was worthwhile highlighting the half-dozen uncommon desmids encountered in the phytoplankton of Scottish lochs, which adds value to our statutory work and gives these delightful rarities a well-deserved mention for the British Isles. Through sharing this information, we also hope to spark enthusiasm for this exquisitely beautiful group of algae, encourage others to take to the microscope, and help promote the study of phycology in general: we need more field algologists.

ACKNOWLEDGEMENTS

We are indebted to Dr David Williamson for his expertise in verifying the identities of our desmid specimens. We are also grateful to Professor David John (Natural History Museum, London) for giving his expert opinion on our findings. We thank SEPA for providing the lake typology and water chemistry data. We also thank Dr Kevin Murphy (University of Glasgow) for proof-reading an earlier version of the manuscript.

REFERENCES

Brodie, J., John, D.M., Tittley, I., Holmes, M.J. & Williamson, D.B. (2007). *Important Plant Areas for algae: a provisional review of sites and areas of importance for algae in the United Kingdom*. Plantlife International, Salisbury, U.K.

Brodie, J., Codd, G.A. & Mann, D. (2008). The decline in the number of algal taxonomists in the U.K. *The Phycologist* 75, p. 23.

Brook, A.J. (2002). Phylum Chlorophyta (Green Algae) Family Mesotaeniaceae ('Saccoderm Desmids') p. 510 – 593 In; John, D.M., Whitton, B.A. & Brook, A.J., (editors) *The Freshwater Algal Flora of the British Isles*, 1st Edition. Cambridge University Press, Cambridge.

Brook, A.J. & Williamson, D.B. (2010). *A Monograph on some British Desmids*. The Ray Society, London.

Brook, A.J., Williamson, D.B. & John, D.M. (2011). Phylum Chlorophyta (Green Algae) Family Mesotaeniaceae ('Saccoderm Desmids') p. 609 – 741. In; John, D.M., Whitton, B.A. & Brook, A.J., (editors) *The Freshwater Algal Flora of the British Isles*, 2nd Edition. Cambridge University Press, Cambridge.

Coesel, P.F. & Krienitz, L. (2008). Diversity and geographic distribution of desmids and other

coccoid green algae. *Biodiversity and Conservation* 17, 381 – 392.
European Commission (2000) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. *Official Journal of the European Communities* L327, 1 – 72.
Goodyer, E. (2013). Quantifying the Desmid Diversity of Scottish Blanket Mires. PhD Thesis, University of Aberdeen.
John, D.M. & Williamson, D.B. (2009). *A Practical Guide to the Desmids of the West of Ireland. Martin Ryan Institute*, National University of Ireland, Galway.
John, D.M., Williamson, D.B. & Guiry, M.D. (2011). A Catalogue of the desmids (Streptophycophyta, Zygnematophyceae, Zygnematales) of Ireland. *Occasional Papers* 15, 1 – 83, National Botanic Gardens, Glasnevin, Dublin.
Lang, P., Procházková, L., Krokowski, J., Meis, S., Spears, B.M., Milne, I. & Pottie, J. (2013). The bizarre Eustigmatacean alga, *Pseudostaurastrum limneticum* (Borge) Chodat, in a shallow, nutrient-enriched Scottish loch: new to the British Isles. *The Glasgow Naturalist* 26, (*in press*).

Hoverfly records from Coll and Tiree (Diptera, Syrphidae)

E. Geoffrey Hancock[1], Jeanne Robinson[2] & Mary Sumner[3]

[1]The Hunterian (Zoology Museum), University of Glasgow, G12 8QQ; [2]Jeanne Robinson, Glasgow Museums, Glasgow Museum Resource Centre, Woodhead Rd, Glasgow, G53 7NN; [3]Mary Sumner, 3 Strathburn Gardens, Inverurie, Aberdeenshire, AB51 4RY

INTRODUCTION

There is little published literature on the hoverflies (Diptera, Syrphidae) from the adjacent isles of Coll and Tiree, outermost of the Ebudes (Inner Hebrides). New hoverfly records resulting from visits to the islands of Coll and Tiree in 2010 (Hancock & Robinson) and Tiree in 2012 (Hancock) initiated a search for earlier relevant records. The list below is augmented with previously unpublished data extracted from the Boyd Barr collection held at the The Hunterian (Zoology Museum), Glasgow. Barr collected generally in the west of Scotland and had a particular interest in the genus *Microdon*, populations of which were studied on Mull (Barr, 1995; Schönrogge, *et al.*, 2008). He resided on Coll for short periods between 1994 and 1996 and collected hoverflies but did not publish details or forward data to the national Hoverfly Recording Scheme so his records were not included in the maps of Ball *et al.* (2011).

Published records from Tiree in Skidmore (2008) were mostly his own observations from 25-29 June 1999. These missed being incorporated in Ball *et al.* (2011) but there are a number of 'dots' representing species records from both islands derived from earlier sources. These sources have been identified and so can be included here for completeness. These comprise a list of hoverflies recorded by Joan Childs from The Reef (RSPB Reserve), Tiree in August 2009 and data extracted by Kenn Watt from specimens in the Arthur B. Duncan and Ian C. Christie collections at the National Museums Scotland (NMS), Edinburgh. These specimens are from both Tiree and Coll, captured between 1985 to 1999. Thus the list summarises all available data that have been located on hoverflies from Coll and Tiree.

SPECIES LIST

Nomenclature follows Chandler (1998) with some updates given by Ball *et al.* (2011). Following the arrangement in these two works the species are presented in alphabetical order, due to fluidity in hoverfly higher classification. The collection details are abbreviated and the abbreviations are explained at the end of the species list.

Cheilosia illustrata (Harris). **Coll**, Grishipol, 1984 (KW in Ball et al., 2011)
Dasysyrphus tricinctus (Fallén). **Coll**: BB1
Episyrphus balteatus (De Geer). **Tiree**: 8, [Skidmore]
Eristalinus aeneus (Scopli). **Tiree**: 8; **Coll**: BB1, BB2, Meall nan Man, 1984 (KW in Ball et al., 2011)
Eristalinus sepulchralis (Linnaeus). **Tiree**: 3, [Skidmore], Hough, 1974 (KW in Ball et al., 2011)
Eristalis abusivus Collin. **Tiree**: [Skidmore]
Eristalis arbustorum (Linnaeus). **Tiree**: 8, [Skidmore], Hough, 1974 (KW in Ball et al., 2011); **Coll**: 4; BB2, BB4, Meall nan Man, 1984 (KW in Ball et al., 2011)
Eristalis horticola (De Geer). **Tiree**: 3, 8, [Skidmore]; **Coll**: BB4
Eristalis intricarius (Linnaeus). **Tiree**: 1, 8, [Skidmore], Hough, 1974 (KW in Ball et al., 2011); **Coll**: BB2, Torastan, 1974 (KW in Ball et al., 2011)
Eristalis tenax (Linnaeus). **Tiree**: 8
Eupeodes corollae (Fabricius). **Tiree**: 1, 8, [Skidmore]; **Coll**: BB1, BB4
Eupeodes latifasciatus (Macquart). **Tiree**: 8
Eupeodes luniger (Meigen). **Tiree**: 8
Helophilus pendulus (Linnaeus). **Tiree**: 5, [Skidmore], Hough, 1974 (KW in Ball et al., 2011); **Coll**: 4, BB1, BB2, BB4, Torastan, 1984 (KW in Ball et al., 2011)
Helophilus trivittatus (Fabricius). **Tiree**: 2; **Coll**: BB2